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NOTES ON CLAVARIOID FUNGI. I. THE CLAVULINA CASTANEOPES COMPLEX

Ronald H. Petersen

(with 6 figures)

The genus *Clavulina* Schroeter (**1889**) was segregated from *Clavaria* on the presence of two-sterigmate basidia which bear subglobose, smooth hyaline spores and which become septate upon liberating the spores. In common with other segregate genera of the Clavariaceae, *Clavulina* received little attention, the species usually being placed in synonymy. Donk (**1933**) transferred the genus from the Clavarioideae to the Cantharelloideae, thus focusing attention on the name once more. Singer (**1945**) equivocated somewhat on the practical validity of the genus, but recognized its theoretical segregation. Corner (**1950**) recognized the genus, adding several tropical species to the existing temperate ones.

Peck (**1872**) reported *Clavaria trichopus* Persoon from New York State, but differed with Fries's concept of the species. Some time later (**1908**), recognizing the obvious differences between his increasing collections and Fries's and Persoon's descriptions, he described the organism as *Clavaria ornatipes.* Coker (**1923**) placed the species in his subgroup four with related species, but Doty (**1944**) further segregated it as the sole member of the section *Ornatipes* of the genus *Clavaria.* Corner (**1950**) transferred it to *Clavulina.*

Because dried specimens assume a somewhat tough texture, Burt (**1922**) transferred the species to *Lachnocladium.* Earlier (**1919**) he had also transferred Peck's *Clavaria bicolor* (not *C. bicolor* Massee = *C. zollingeri* Lév.) to *Lachnocladium* without examining Peck's type specimen. Later (**1922**), he recognized *C. bicolor* Pk. as distinct and *L. bicolor* Burt became synonymous with *C. ornatipes.*

Atkinson (**1908**) described *Typhula castaneopes* from the southern Appalachian Mountains. Because fruiting bodies did not arise from sclerotia, the type specimen was included with the genus *Clavaria* in his collections, possibly for future transfer to that genus.

Corner (**1950**) transferred *Clavaria ornatipes* and *Typhula castaneopes* to *Clavulina,* apparently on the basis of literature descriptions and his own collections of the former from southeast Asia. He placed

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C. ornatipes in the subgenus *Fusco-clavulina* because of the pale brown pigment in the walls of the cortical hyphae of the stem and branches, but *C. castaneopes* (sub *castaneipes*) was placed in the subgenus *Euclavulina,* which was characterized as possessing clamps but no cystidia or pigmented hyphae.

Upon examination, the type specimen of *T. castaneopes* proves to be excellent material of *C. ornatipes.* Thus the problem of priority is raised. The report of the State Botanist of New York for 1907 was issued on August 15, 1908. Annales Mycologici did not publish the date of issue, but the New York Academy of Medicine library received the first number of volume six (including the description of *T. castaneopes*) on April 22, 1908, a full two months before the former publication. Therefore, *Typhula castaneopes* Atkinson is the earlier name of the taxon and includes *Clavaria ornatipes* Peck.

CLAVULINA CASTANEOPES (Atkinson) Corner. Ann. Bot. Mem. **1**: 306. 1950.

Basionym: *Typhula castaneopes* Atkinson. Ann. Mycol. **6**: 60. 1908.

= *Clavaria ornatipes* Peck. Bull. N. Y. State Mus. **122**: 18, 160. 1908.

= *Lachnocladium ornatipes* (Pk.) Burt. Ann. Missouri Bot. Gard. **9**: 65–66. 1922.

= *Clavulina ornatipes* (Pk.) Corner. Ann. Bot. Mem. **1**: 333–335. 1950.

= *Lachnocladium bicolor* Burt. Ann. Missouri Bot. Gard. **6**: 274. 1919. (non *Clavaria bicolor* Peck.)

Illustrations: Coker (**1923**) pl. 9, 15, 83; Corner (**1950**) text-fig. 24, 28–30, 142–143, pl. 15; Burt (**1920**) pl. 5, fig. 6, text-fig. 13 (**1922**) pl. 11; Kauffman (**1926**) pl. 1, fig. 1.

Fruit-body 2–7 cm tall, composed of a distinct stem-like portion and a flattened, hymenium-bearing area, usually branched but occasionally simple, especially in young or small plants. Stipe long (1.5–6 cm) some shade of dull tan or brown, clothed with fascicles of hyphae which give it the appearance of being strigose, fibrillose or hispid, these fascicles usually extending nearly to the base of the branches, which are often longitudinally ridged or grooved, especially in the upper portions. Hymenial portion occasionally simple, then flattened, somewhat palmate and longitudinally grooved, but usually divided into few to several hymenium-bearing branches, some shade of dull tan to leaden grey, retaining color well on drying. Branches subpalmate to palmate, flatened irregularly, rarely dichotomous, occasionally trichotomous, longitudinally grooved or ridged, especially below furcation, somewhat light in color in fresh material, but concolorous with the stipe on drying.

Medullary hyphae of the stipe composed of long cells (20–150 × 4–10 μ), often slightly swollen (–20 μ), especially around the septa, causing the septa to appear oblique, rarely highly swollen (–35 μ), hyaline, thin-walled, rather loosely arranged, often with regular patterns of curving or zig-zag throughout much of their length, sparcely branched, with no clamps. Cortical hyphae linear, composed of unswollen (rarely slightly swollen) long cells, with pale watery fuscous brown walls slightly thickened (not more than 0.5 μ in my material), branching and anastomosing

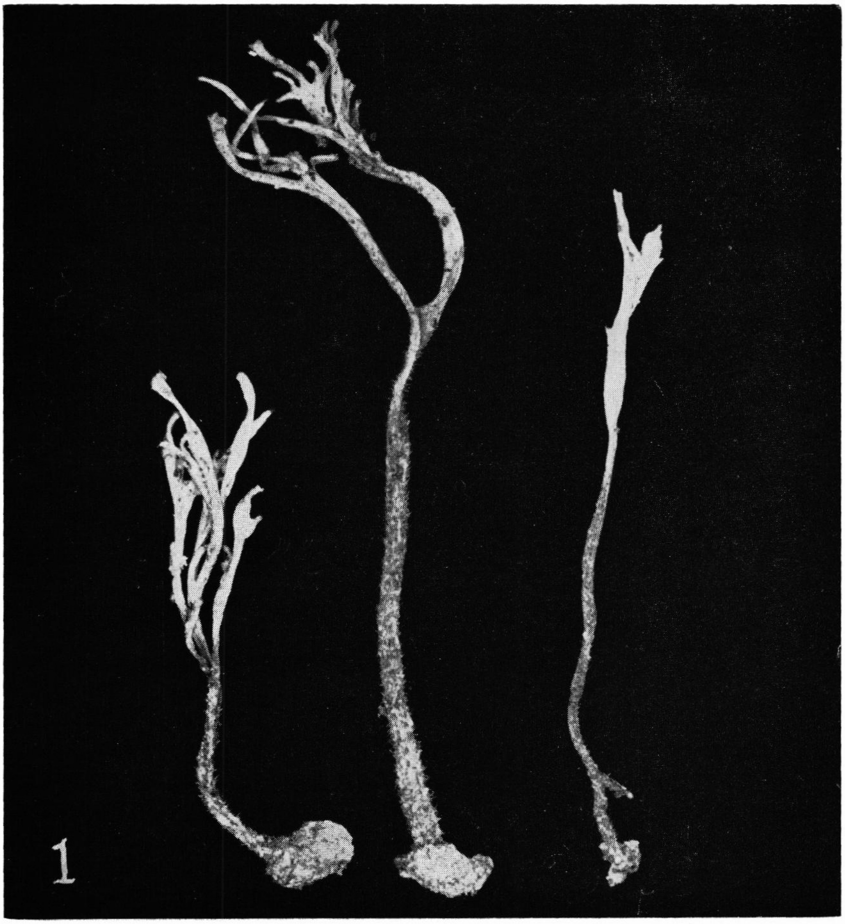


FIG. 1. *Clavulina castaneopes* var. *castaneopes*. RHP152.

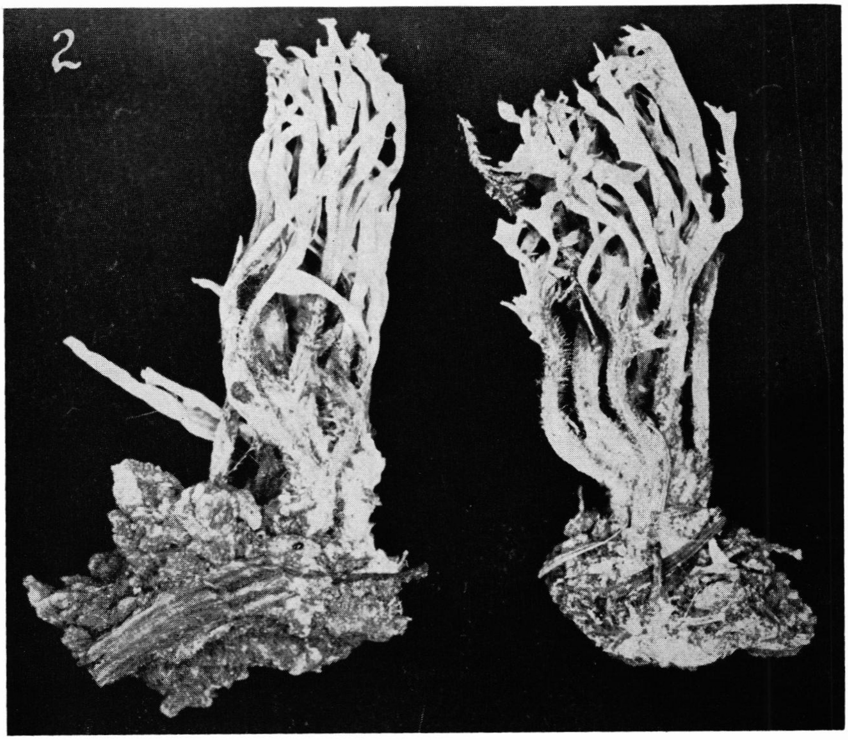


FIG. 2. *Clavulina castaneopes* var. *lignicola.* UMH (type).

freely throughout their length. Hyphae often passing from one tissue into another and back, assuming the characteristics of the surrounding cells.

Hispid fascicles of hyphae on the stipe composed of the latter cell type, with some swollen cells in the center, depending on the size of the fascicle, these hyphae all unclamped.

Hymenium when first fertile 30–60(–90) μ thick, sometimes thickening in age to at least twice the original thickness. Subhymenium composed of freely branching, usually unswollen cells, thin-walled, rarely with some clamps. Basidia mostly homogeneous in content (in aqueous phloxine), occasionally clamped at base, surmounted by 2 (rarely 1) stout, cornute, long (4–8 μ) sterigmata. Basidia becoming secondarily septate after spore discharge, the apical portion evacuating and collapsing.

Spores globose, subglobose, suboval, to pip-shaped, smooth, thick-walled, 1-guttate (no material seen to the contrary), soon becoming aguttate in dried specimens (FIG. 6).

In microscopic detail, the species is quite typical of the genus. The 2-sterigmate basidia and globose or subglobose hyaline smooth spores certainly leave no doubt as to identity of the species. Kauffman (**1926**) reports 3-spored basidia, but Corner (**1950**) rejects this, as I must from observations of many specimens. However, the species seems somewhat atypical of the genus in its small size and tough texture, as well as its coarsely strigose stipe.

The species is widely distributed on this continent (Leathers, **1955**; Wehmeyer, **1935**; Kauffman, **1926**; Overholts, **1920**) and in Asia (Imai, **1934**; Thind, **1961**), but is apparently absent from Europe. The major collections of the species in this country are from two general areas—the eastern states, centering around New York and the southern Appalachian Mountains, and the northwestern states, centering around Washington and Oregon. Several characteristics being analyzed, the specimens examined fall into two distinct groups, which are proposed as varieties of the species.

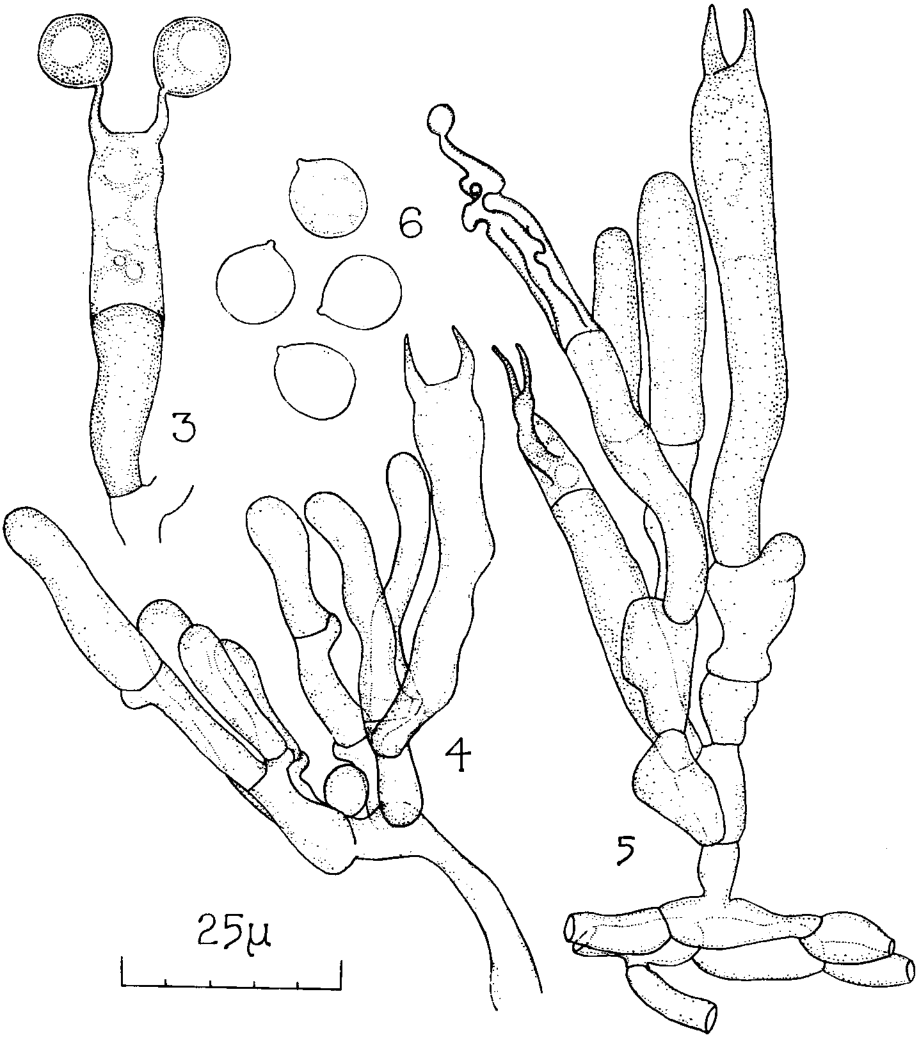
Specimens from the eastern states are invariably slender (the stipe less than 4 mm wide) and appear spindly. The type specimen of *C. ornatipes* and one other specimen also from Sand Lake, N. Y., possess basidial and subbasidial clamps, but all other eastern specimens are devoid of all evidence of clamps (FIGS. 3, 5). In the east, the species is found on wet clay soil, often on shady exposed banks covered by moss protonemata or algae, but no specimens were seen to have occurred on wood. This is the typical variety.

CLAVULINA CASTANEOPES var. **castaneopes** FIG. 1

Fungus terricolous. Carpophores –7 cm high. Stipe slender (1–4 mm thick), dull brown. Branches tan or grey, ending acutely. Basidial and subbasidial clamp connections rarely observed, spores average 9.8 × 8.5 μ.

Holotype: CUP: Atkinson (TYPE of *C. castaneopes*).

Selected specimens examined (sub *C. ornatipes* unless otherwise noted); NYS: Sand Lake (TYPE of *C. ornatipes,* sub *C. trichopus* Pers.), Sand Lake (2), Felt House (sub *C. trichopus*), Catskill Mts. (sub *C. argillacea*); BPI: Lloyd 38760, 38762, 42111, Missouri Bot. Gard. 57427 (TYPE of *Lachnocladium bicolor* Burt), Hesler 9259; K: N. Rhodesia, Singapore; UMH: Wehmeyer (Nova Scotia); NY: Goldsmith, Rogerson, Coker 5671; UNC: Davis, Linville Falls, Highlands 9571, 13029, 13467, Kauffman 807; CUP: Davis; YNU: Imai 18IX31, 10IX36; FH: Farlow (2), Chocorua (sub *L. bicolor* (Pk.) Burt), Magnolia (sub *Thelephora multipartita* Schw.).



FIGS. 3–6. 3. Unclamped basidium of var. *castaneopes* showing secondary septation and nearly mature spores. 4. Clamped basidia and primordia of var. *lignicola*. 5. Unclamped hymenial hyphae of var. *castaneopes* showing two effete basidia with secondary septation and a nearly mature basidium with rudimentary secondary septation. 6. Spores of var. *castaneopes*.

Specimens from the far west are lignicolous or sublignicolous (growing on bark or ligneous duff), and generally much stouter than eastern material, the stipe usually being 4–8 mm thick. The stipe and branches are nearly concolorous, the branches ending in blunt or obtuse apices.

Basidial and subbasidial clamps are commonly observed in specimens from Washington, Oregon and British Columbia (FIG. 4). Moreover, the general size of the spores from these specimens is matched by only two specimens from the eastern collections (TABLE I).

TABLE I

SPORE DIMENSIONS IN CLAVULINA CASTANEOPES

Herbarium	Collection area	Spore dimensions μ (average)
var. *castaneopes*		
CUP[a]	N. C.	9.8 × 8.2
NYS[b,c]	N. Y.	10.2 × 8.1
NYS	N. Y.	10.8 × 9.5
BPI	Mass.	9.8 × 8.9
BPI	N. C.	9.4 × 8.3
RHP[d]	N. C.	9.3 × 7.8
RHP[d]	N. C.	9.4 × 8.0
NY	N. C.	9.2 × 7.7
YNU	Japan	9.7 × 8.7
K[c]	Singapore	9.7 diam.
var. *lignicola*		
UMH[a]	Wash.	10.3 × 8.8
OSC	Oregon	10.4 × 9.6
UC	Brit. Col.	9.6 × 9.3
UMH	Oregon	10.2 × 8.8

[a] Type specimen of the taxon.
[b] Type specimen of *C. ornatipes*.
[c] See text for further notes on these specimens.
[d] Personal herbarium of the author.

CLAVULINA CASTANEOPES var. **lignicola** Petersen, var. nov. FIG. 2

Fungus crescens in ligno vel cortis. Carpophorae –7 cm altae. Caulis crassis (4–8 mm latis), plerumque concolorus hoc ramis, fuscus obscurus vel fuscus clarus. Rami obtuse terminant. Fibulae basidiaeque subbasidiae saepe observerant. Sporae typicae 10.1 × 9.3 μ.

Typus: D. Stuntz & Knowles (A. H. Smith 30188), Lower Tahoma Creek, Mt. Rainier National Park, Wash. UMH.

Fungus growing on wood or bark. Carpophores –7 cm high. Stipe stout (4–8 mm thick), usually concolorous with the branches, dull tan or brown. Branches ending bluntly or obtusely. Basidial and subbasidial clamp connections are often observed. Spores average 10.1 × 9.3 μ.

Selected specimens examined (sub *C. ornatipes*): OSC: Doty 3016; UC: McCabe (Brit. Col.); UMH: Leathers 299, Smith 30587, Wehmeyer-Kauffman (sub *L. ornatipes*).

The Japanese material seems very similar to our eastern variety. Specimens are small and slender, and do not possess clamps. Spore size is within the normal range.

Corner's specimen from near Singapore (K) is completely unrecognizable. The plant is now totally black, the stipe being strigose near the base only. Probably because of poor storage conditions in the orient, microscopic features have been completely obliterated, neither spores, hymenium or even hyphae being distinguishable. Branching appears dichotomous or trichotomous, the branches being very thin (ca. 1 mm thick), ascending, rounded, not markedly palmate. It is impossible to consider the specimen under the above name.

The sole specimen from Africa (K) is also not characteristic of the species. Much branched, the color much brighter (a dusty orange), the specimen shows bold clamps at every septum, both tramal and hymenial. In an accompanying note, Corner speculates that the specimen may represent a distinct but closely related species. I agree with this conclusion.

Clavaria bicolor Peck must be segregated from this species. It is neither a *Lachnocladium* nor *Clavulina*. The only specimen of *C. bicolor* at NY is not a member of the Homobasidiomycetes, but of the Dacrymycetaceae of the Tremellales—probably the genus *Calocera* Nees ex Fr (Kennedy 1958).

It is interesting to note that the two specimens of *C. castaneopes* var. *castaneopes* with oversize spores also bear some basidial and subbasidial clamp connections. They are both from the same location and may represent a somewhat unique genetic strain. If clamps are indicative, these specimens may represent a dikaryon condition while the remaining eastern material may represent monokaryons. Unfortunately, cytological studies on dried specimens cannot be accomplished.

Maire (1902), Juel (1916) and Donk (1933) reported on the nuclear condition of the basidial primordium in the Clavariaceae. In all the species of *Clavulina* studied, a stichoid division pattern has been noted, and this would be expected in *C. castaneopes*.

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